

FILES AND SCRAPERS: CIRCUMSTANTIAL EVIDENCE FOR STRIDULATION IN THREE SPECIES OF *AMBLYCERUS*, ONE NEW (COLEOPTERA: BRUCHIDAE)

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Abstract.—*Amblycerus stridulator* NEW SPECIES, *A. pollens* (Sharp) and *A. eustrophoides* (Schaeffer) have in common a fusiform node with transverse striations on the metepisternum and an apical tooth on the metafemur. The fusiform node (file) and the apical tooth (scraper) may be stridulatory organs. Similar structures in criocerine Chrysomelidae are discussed and compared to the bruchids. *Amblycerus eustrophoides* and *A. pollens* are redescribed. *Amblycerus stridulator* NEW SPECIES is described from Mexico. The species differ in the sclerites in the internal sac, patterns of pubescence, and the position of the fusiform node on the metepisternum.

Key Words.—*Amblycerus*, taxonomy, Mexico, *A. stridulator*, *A. pollens*, *A. eustrophoides*, Bruchidae, stridulation

This paper describes a new species and redescribes two named species of *Amblycerus* that have structures that may be stridulatory organs. To our knowledge, no bruchid is known to stridulate nor to have structures that resemble those reported here.

Our studies were stimulated by the observation by Kingsolver (1970) that *Amblycerus eustrophoides* (Schaeffer) has a unique structure for bruchids: a fusiform node with transverse striations on the metepisternum. He hypothesized that this structure “was apparently a stridulatory mechanism” when rubbed against a spine on the ventral margin of the metafemur. Thus, the structure on the metepisternum may be a stridulatory file and the spine on the metafemur a scraper (plectrum).

Amblycerus stridulator NEW SPECIES, described here, and *A. pollens* (Sharp) and *A. eustrophoides*, redescribed here, are the other two species of *Amblycerus* known to have these structures. No living specimens have been analyzed, so we do not know whether these structures are, in fact, stridulatory in function. We believe, however, that it is very important to present our accumulated morphological data here for its heuristic value.

Amblycerus is a large genus with 102 described species (Kingsolver 1990) and has a wide distribution, especially in the Neotropics.

AMBLYCERUS EUSTROPHOIDES (SCHAEFFER)

Spermophagus eustrophoides Schaeffer 1904: 228.

Amblycerus eustrophoides: Johnson 1968: 1268; Bottimer 1968: 1012; Kingsolver 1970: 4; Johnson & Kingsolver 1981: 410.

Type.—Lectotype. Locality: FLORIDA. *PALM BEACH Co.*: Lake Worth; Depository: U.S. National Museum of Natural History, Washington, D.C.; Schaeffer 1907: 293; Leng 1920: 306.

Redescription.—Length (pronotum–elytra) 4.9–6.5 mm. Width 3.1–4.0 mm. Maximum thoracic depth 2.3–3.1 mm.

Male.—*Integument Color.* Body uniformly red to dark red; frons and clypeus sometimes dark brown; eyes silvery or black.

Vestiture. Body covered with silvery gray setae; on elytron each foveola with 1 brown seta; pygidium with narrow median line of setae. *Structure.* Head. Elongated, densely punctulate; frons with median impunctate line extending from frontoclypeal suture to middle of frons. Eye ovoid, cleft to $0.2\times$ its length by ocular sinus; medial margin of eye with row of long, golden setae. Segment 1 of antenna about $2\times$ longer than second; third segment $1.8\times$ longer than second; remaining segments more or less with proportions as first; antenna reaching middle area of hind coxa. Clypeus covered with punctures. Labrum with few punctures. *Prothorax.* Disk subcampanulate, median basal lobe weakly convex, basal margin with carina. Dorsal surface of pronotum punctulate with deep foveolae scattered on surface; lateral carina extending to anterior corner, not reaching cervical sulcus; cervical sulcus extending to midline, with 3 cervical setae. Prosternum flat, constricted between coxae, carinate laterally; proepisternum with foveolae on anterior half. *Mesothorax and Metathorax.* Scutellum slightly elongate, finely punctulate, $1.5\times$ as long as wide, lateral margins straight, strongly tridentate at apex. Elytron $2.2\times$ as long as broad; striae regular, weakly impressed and deeply punctulate; strial intervals finely punctured. Mesosternum tongue-like in basal area, finely punctulate, with a mesal sulcus for reception of posterior area of prosternum. Mesepisternum and mesepimeron finely punctulate, without foveolae. Metasternum punctulate with few foveolae on mesal region; longitudinal suture of metasternum $0.4\times$ as long as sternum; antecoxal suture of metasternum interrupted before reaching median sulcus, bending caudad and reaching posterior margin near mesal area of metasternum. Metepisternum punctulate with shallow to deep foveolae over surface; metepisternal sulcus forming right angle with transverse axis slightly curved and reaching lateral margin of metepisternum, longitudinal axis wider, fusiform and striate transversely to form a “file” (Fig. 1). Surface of hind coxa punctulate, densely setose, and foveolate on lateral 0.66, remaining 0.33 polished, impunctate, with a small cluster of punctures near trochanteral insertion; both foveolae and cluster of punctures proximate; metafemur punctulate, without foveolae, with angulate tooth on ventral margin (Fig. 2); lateral tibial calcarium slightly curved, $0.55\times$ as long as basitarsus; mesal calcarium $0.6\times$ as long as lateral calcarium. *Abdomen.* Sterna finely punctulate with few foveolae on lateral surface, with few, long setae on mesal region of each; fifth sternum emarginate at apex; pygidium with terminal margin rounded or slightly truncate, surface finely punctulate, with scattered foveolae. *Genitalia* (Figs. 3, 4). Median lobe slightly constricted on lateral margins; ventral valve acuminate at apex, arcuate in lateral view; dorsal valve narrow and deeply concave at base; armature of internal sac with 2 basal, subtriangular sclerites with dorsal surfaces finely dentate; 2 median blades with 0.5 of dorsal surface dentate and wishbone-shaped sclerite; 2 irregular, apical, small sclerites; internal sac lined with many fine spinules. Lateral lobes cleft to $0.2\times$ their length (Fig. 4).

Female.—Similar to male, except fifth abdominal sternum not emarginate.

Host plants.—*Drypetes laterifolia* (Swartz): Kingsolver 1970: 475.

Distribution.—Costa Rica, Cuba, Mexico, United States.

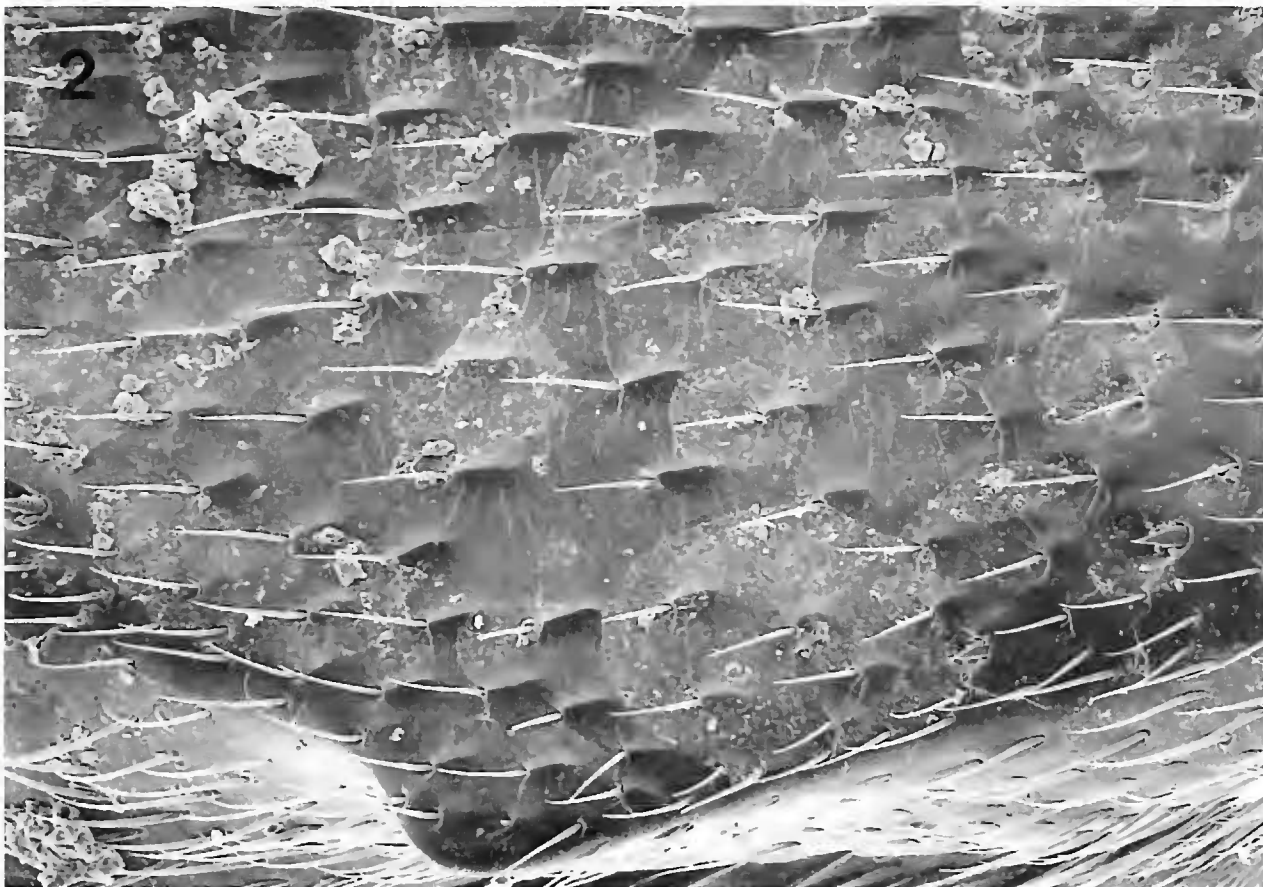
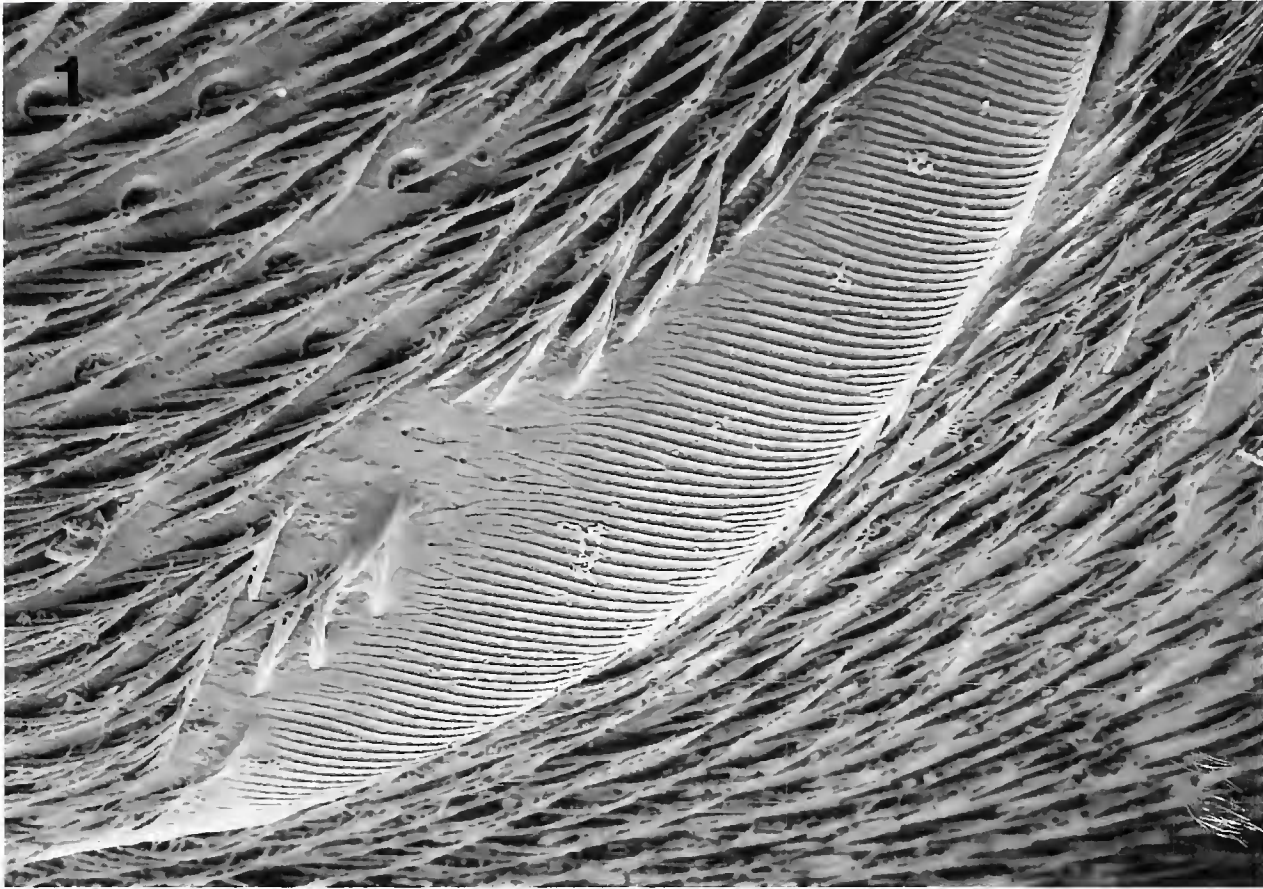
Discussion.—*Amblycerus eustrophoides* is discussed under *A. stridulator*.

Material Examined.—See type. FLORIDA. *DADE Co.*: Matheson Hammock, Coral Gables, 20 Jun 1965, L. & C.W. O'Brien Collectors. MEXICO. *TAMAULIPAS*: Hda. Santa Engracia, May–Jun 1936, M. McPhail, Collector, reared from “huilotillo.”

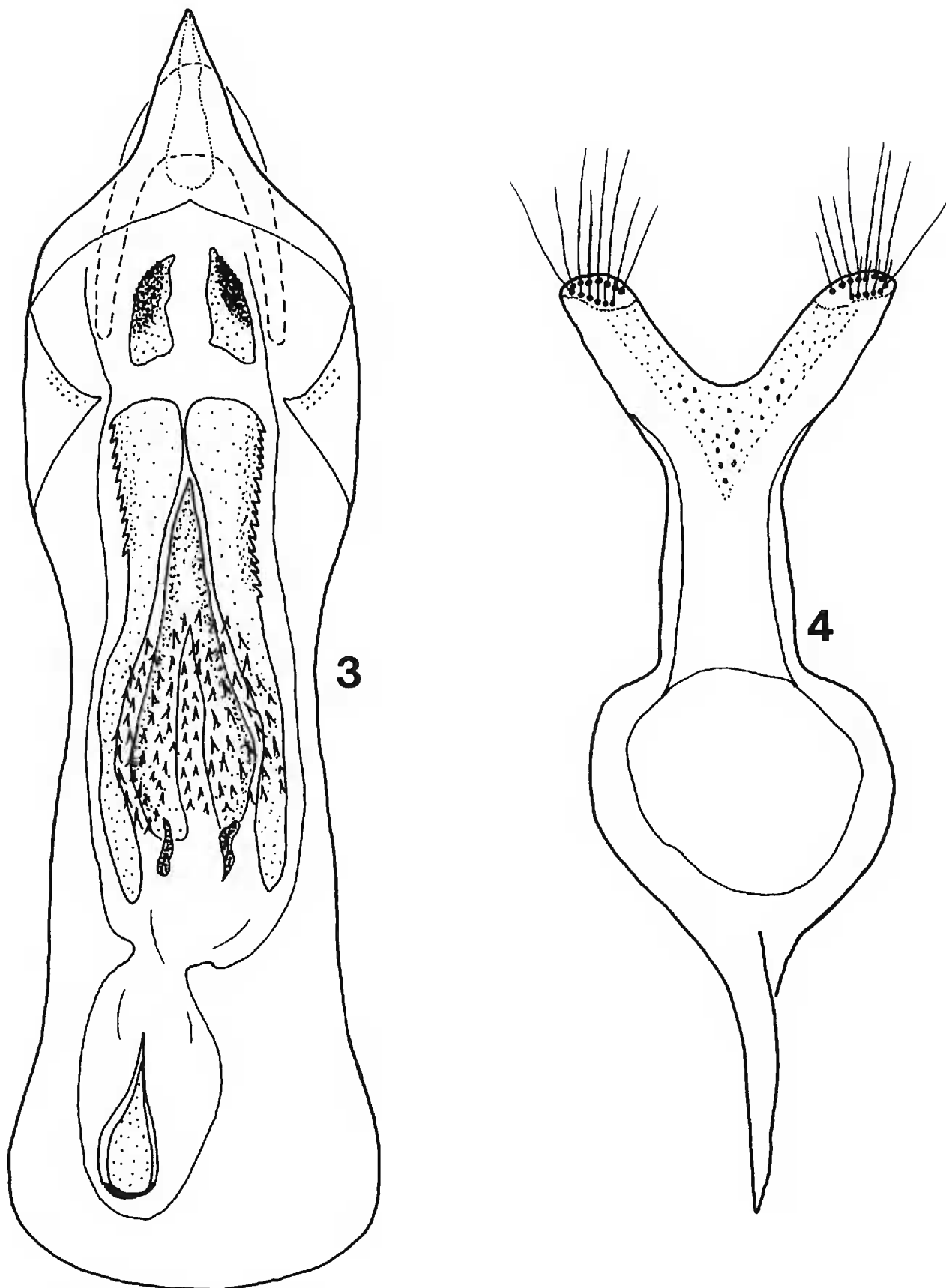
AMBLYCERUS POLLENS (SHARP)

Spermophagus pollens Sharp 1885: 495.

Spermophagus subflavidus Pic 1902: 172 (Type. Locality: “Brésil”; Depository: Museum d'Histoire Naturelle, Paris); Kingsolver 1976: 151.



Figures 1–2. *Amblycerus eustrophoides*. Figure 1. Scanning electron micrograph (SEM) of metepisternum showing “file.” Figure 2. SEM of ventromesal margin of hind leg showing “scraper” or tooth on ventral surface.



Figures 3–4. *Amblycerus eustrophoides*. Male genitalia: Figure 3. Median lobe, ventral view. Figure 4. Lateral lobes, ventral view.

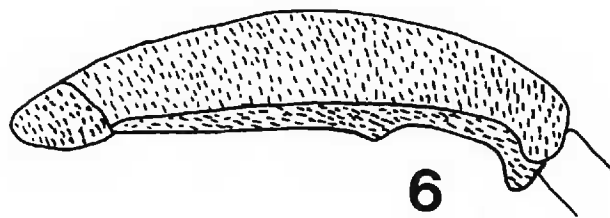
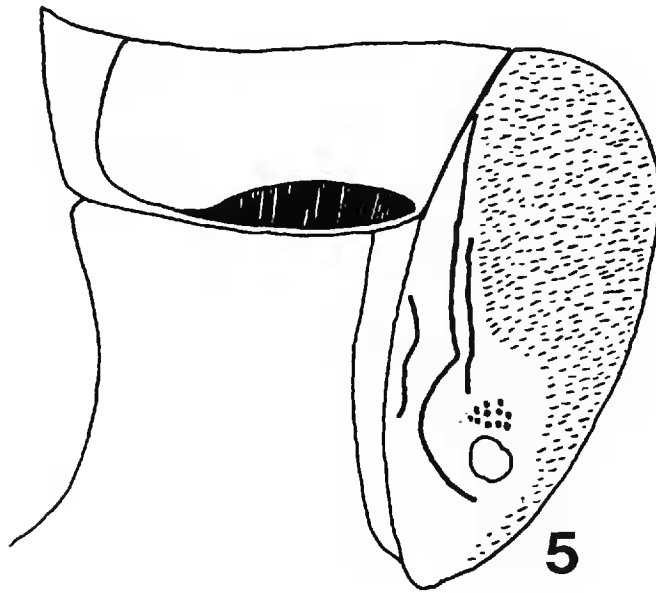
Amblycerus pollens: Blackwelder 1946: 763, Kingsolver 1976: 151, Kingsolver 1980: 238, Johnson & Kingsolver 1981: 410.

Amblycerus subflavidus: Blackwelder 1946: 763, Kingsolver 1976: 151.

Type. — *Spermophagus pollens*. Type Locality: “British Honduras, Belize”; Depository: British Natural History Museum, London).

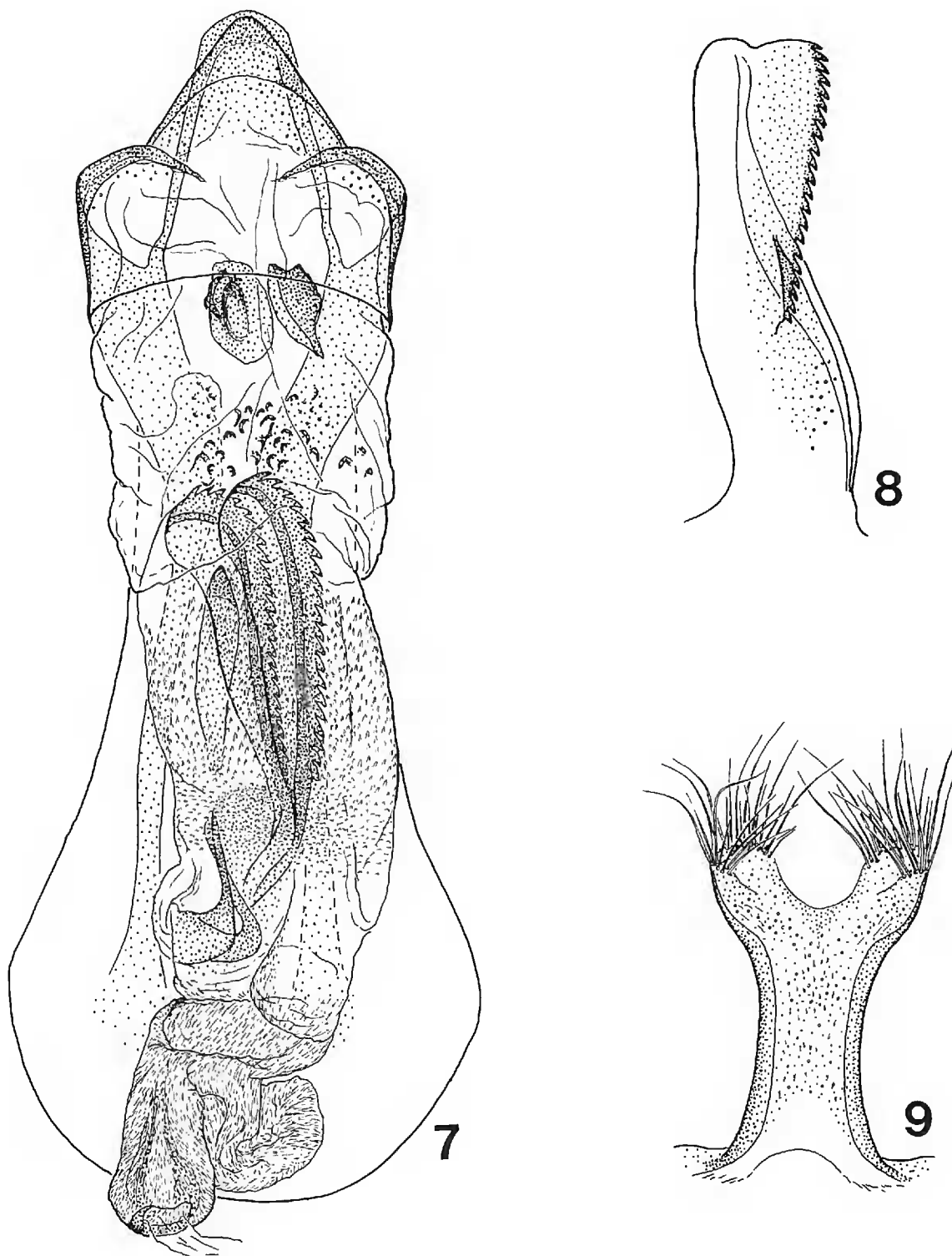
Redescription. — Length (pronotum–elytra) 7.8–8.7 mm. Width 4.5–5.3 mm. Maximum thoracic depth 3.5–4.0 mm.

Male. — *Integument Color*. Pronotum and elytra red-brown, narrow, dark line on lateral margin of



Figures 5–6. *Amblycerus pollens*. Figure 5. a. Metepisternum, b. file and c. metacoxa. Figure 6. Hind leg with short “scraper.”

elytron; rest of the body dark brown or black; elytron, abdomen and pygidium may be yellow in some; eyes silvery or shiny black. *Vestiture*. Pronotum and pygidium covered with orange setae; elytron clothed with very fine orange setae, elytron with ten narrow, vague, longitudinal lines of white setae in striae, very vague in specimens with a slightly yellow integument; rest of the body covered with fine white pubescence, except the inner face of protibia clothed with golden setae. *Structure*. Head. Subtriangular, with many fine punctures interrupted by large punctations; frons with median impunctate line, without evident median carina. Eye width slightly more than base of frons, slightly more narrow at apex; eye cleft $0.20\times$ its length by ocular sinus. Antennal segments with small foveolae; first segment of antennae $2.6\times$ longer than second; third segment $2\times$ longer than second; remaining segments about same length as first segment; antenna reaching anterior margin of hind coxa. Clypeus covered with punctures, except small fringe on apical margin. Labrum covered with fine punctures. *Prothorax*. Disk subcampanulate, median basal lobe weakly convex, basal margin with carina. Dorsal surface of pronotum finely punctulate, with 3 longitudinal lines of fine foveolae on each side; pronotum with lateral carina reaching 0.25 distance to cervical sulcus; cervical sulcus extending dorsad almost to dorsal midline; with 4 cervical setae; lateral margin of pronotum sinuate. Prosternum flat, finely punctate, constricted between coxae, apical portion curved; proepisternum finely punctate with foveolae on anterior half. *Mesothorax and Metathorax*. Scutellum slightly elongate, finely punctulate, with 2 weak sulci, tridentate apically. Elytron $2.7\times$ as long as broad; striae regular, moderately impressed, deeply punctate, principally on anterior 0.33; strial intervals with many fine punctations. Mesosternum linguiform, with mesal sulcus for reception of prosternal process; mesepisternum and mesepimeron finely punctate, without foveolae; metasternum finely punctate, with few deep foveolae; longitudinal suture of metasternum $0.33\times$ as long as sternum; antecoxal suture of metasternum interrupted before reaching median sulcus, bending caudad and reaching posterior margin near mesal area of metasternum. Metepisternum punctulate, without evident foveolae; metepisternal sulcus forming right angle, with the transverse axis curved and reaching lateral margin of metepisternum, lon-



Figures 7–9. *Amblycerus pollens*. Male genitalia: Figure 7. Median lobe, ventral view. Figure 8. Sclerite of internal sac. Figure 9. Lateral lobes, ventral view.

gitudinal axis fusiform, with fine, transverse striations to form fusiform node with transverse striations (Fig. 5). Hind coxa punctate, foveolate, lateral 0.66 and posterior margin densely setose, medial 0.33 polished, impunctate, except for cluster of punctures near trochanteral insertion (Fig. 5); metafemur finely punctate, pubescent with a small angulate tooth on ventral margin (Fig. 6); inner face of metafemur densely punctulate with cluster of foveolae on mesal portion; metatibia finely punctulate with scattered foveolae; lateral tibial calcarium curved, $0.8\times$ as long as basitarsus, mesal calcarium $0.4\times$ as long as lateral calcar. *Abdomen*. Sterna finely punctate with few foveolae on lateral areas; fifth sternum slightly emarginate at apex; pygidium with terminal margin rounded, surface finely punctate with deep foveolae. *Genitalia* (Figs. 7, 8, 9). Median lobe slightly constricted on lateral margins; ventral valve acuminate at apex; dorsal valve narrow, about $0.5\times$ as wide as apex of median lobe, apex gently rounded; in ventral view base of internal sac with armature of two, spiny elliptic plates, 20–25 verrucae; median moderate-sized, acuminate sclerite, and two blade-shaped sclerites with 0.5 of dorsal surfaces serrate; middle and apex of internal sac lined with many fine spinules; triangular gonopore duct sclerite at apex. Lateral lobes cleft to about 0.3 their length (Fig. 9).

Female.—Similar to male except apical margin of fifth abdominal sternum truncate.

Host Plants.—Unknown.

Distribution.—Belize, Guatemala, Costa Rica, Venezuela, French Guiana, Brazil.

Discussion.—*Amblycerus pollens* is discussed under *A. stridulator*.

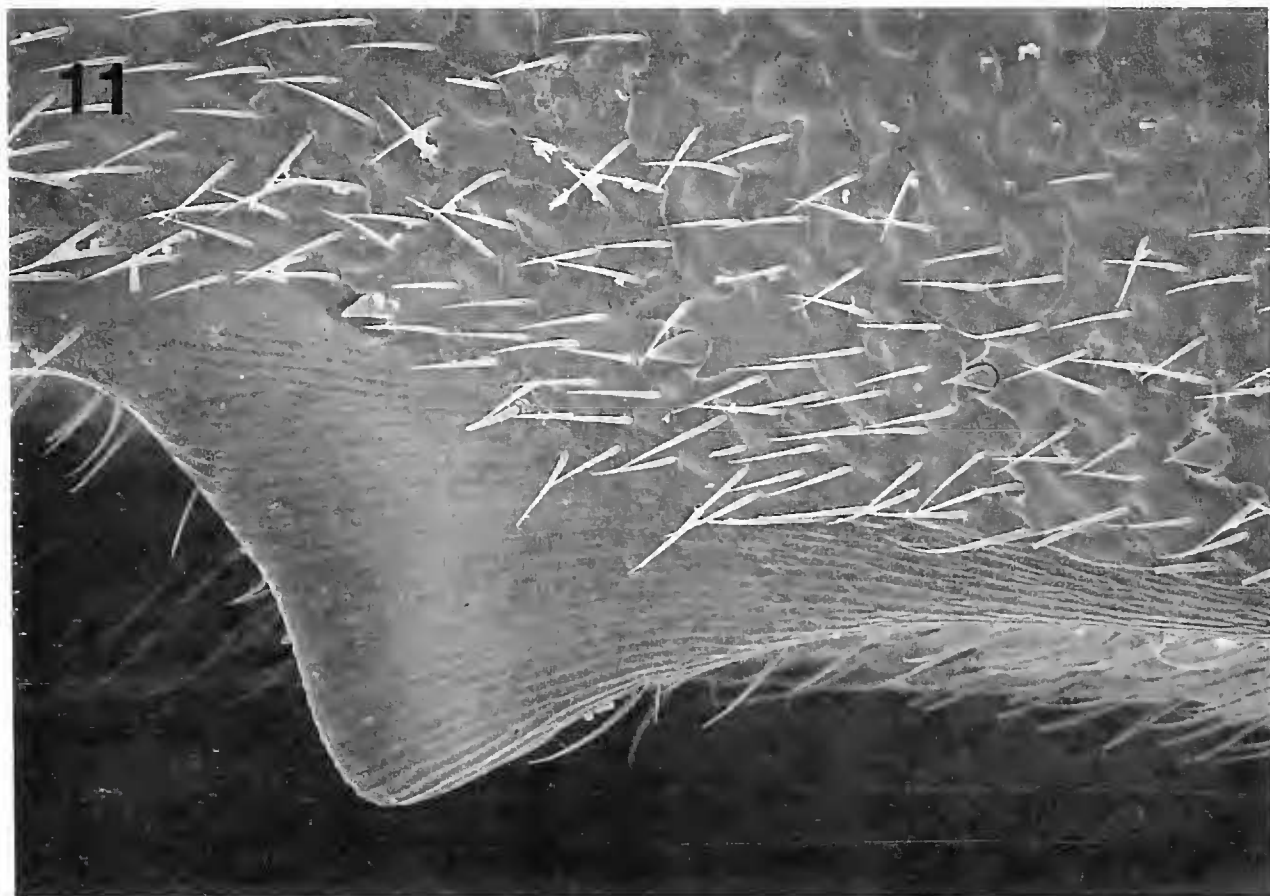
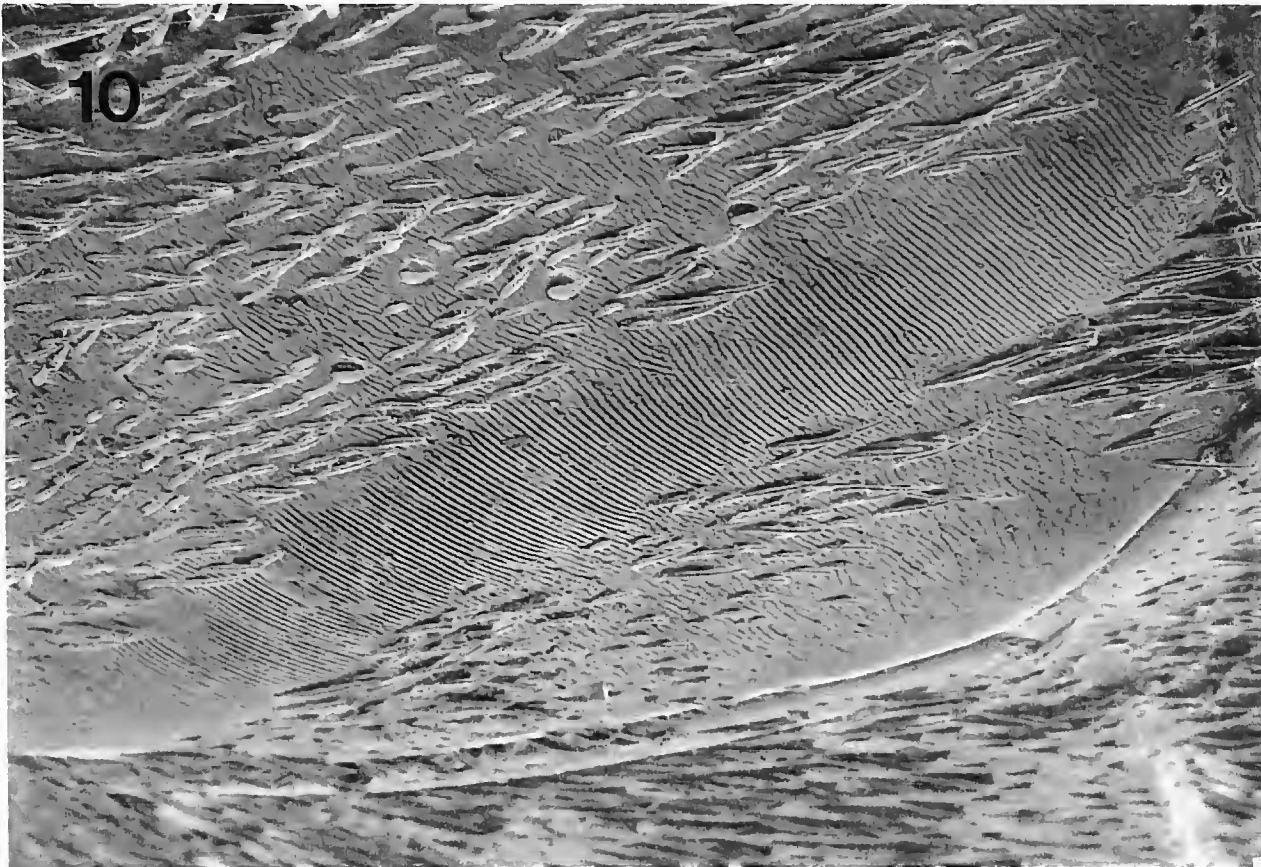
Material Examined.—See type. COSTA RICA. PUNTARENAS: Puntarenas, 28 May 1971, J. Fox, collector. Brésil.

AMBLYCERUS STRIDULATOR, NEW SPECIES

Type Series.—MEXICO. JALISCO: Estación de Biología, Chamela, 17 Feb 1985, ex seeds *Caesalpinia sclerocarpa* Standley, T.H. Atkinson (THA 167). Allotype and 4 paratypes, same data. Other paratypes: Same locality as holotype but April 1980, ex seeds *Caesalpinia sclerocarpa*, A. Pescador; same locality but 17 Jul 1987, R. Turnbow. SINALOA: 10.8 km (6 mi) N Mazatlan, nr. beach, 26 Feb 1973, reared seeds #215-73, *Caesalpinia sclerocarpa*, emerg. 15 Mar 1973, C.D. Johnson. OAXACA: Port Guatulca, 3 Dec 1937, Zaca Exped. Acc. 37483. COSTA RICA. PUNT.: Monteverde, 1400 m, 12–14 Aug 1987, 24 Aug 1987, H. & A. Howden. VENEZUELA. LARA: 4 km N La Pastora, 2–3 Mar 1978, riparian forest, J.B. Heppner. Holotype and paratypes deposited in the collection of the Universidad Nacional Autónoma de México, México, D.F. Allotype and paratypes deposited in the U.S. National Museum of Natural History, Washington, D.C. Paratypes also deposited in the American Museum of Natural History, New York; the H. & A. Howden collection, Ottawa, Ontario, Canada; the C. D. Johnson collection, Flagstaff, Arizona; and the Departamento de Biología, Universidade Federal do Paraná, Curitiba, Brazil.

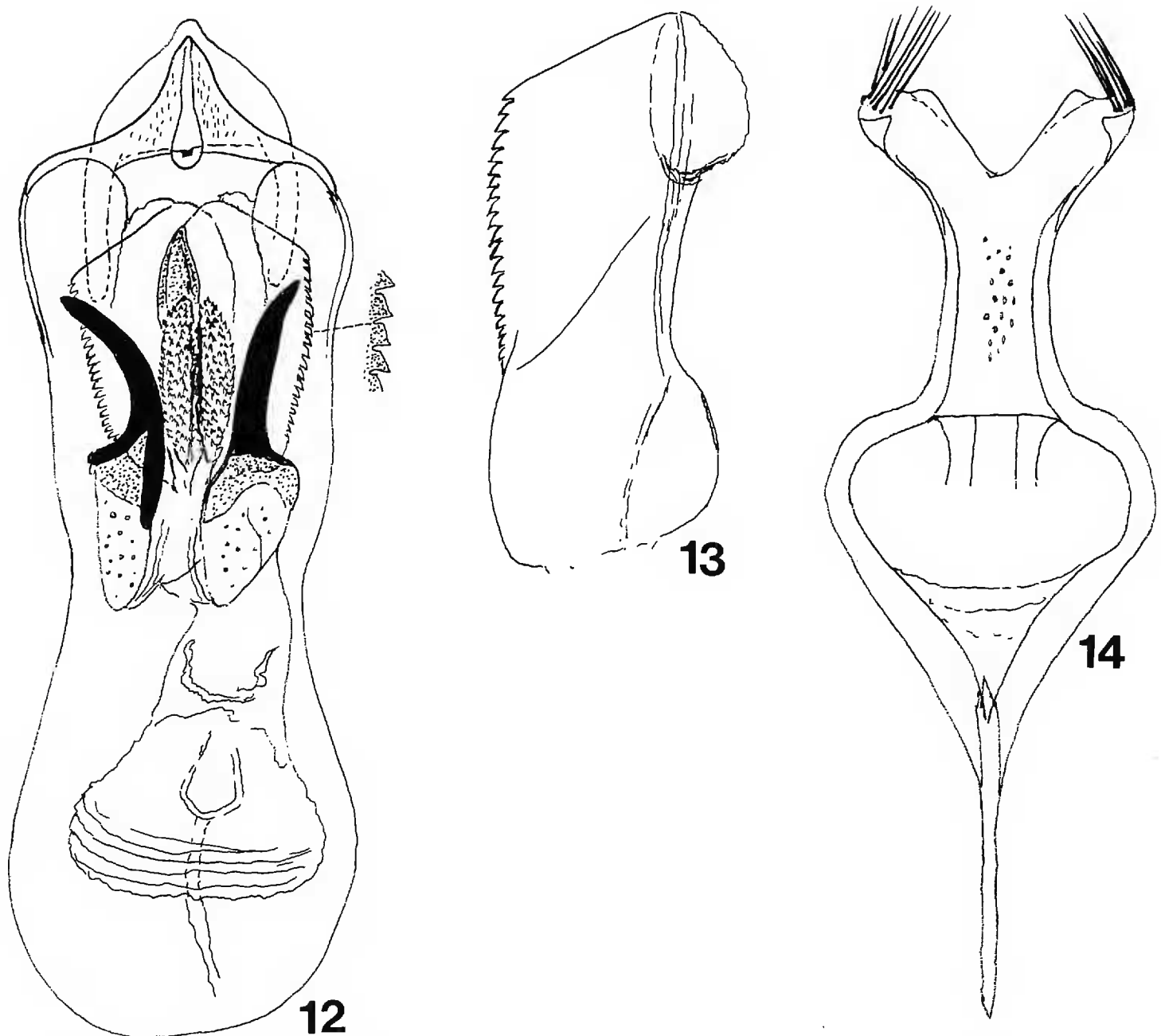
Description.—Length (pronotum–elytra) 5.3–7.7 mm. Width 3.2–4.5 mm. Maximum thoracic depth 2.3–3.1 mm.

Male.—*Integument Color.* Body red-brown to piceous, eye black, antenna mostly piceous, metatibia and metatibial spurs dark red. *Vestiture.* Mostly with gray setae but with scattered spots of red-brown setae on pronotum and elytra; venter of body gray except slightly yellow along posterior border of each abdominal sternum, and slightly yellow spots along lateral margin of abdomen; tarsal pads yellow; pygidium with median line of gray setae. *Structure.* Head. Turbiniform, eyes strongly protuberant, coarsely faceted, ocular sinus less than $0.2 \times$ length of eye; frons narrowed toward frontoclypeal suture, frontal carina obtuse, frons finely, densely punctate, clypeus more strongly punctate, labrum finely punctate and setose along basal border, finely fringed on apical margin; basal antennal segment $3 \times$ length of second, segments 4–10 serrate, eleventh subelliptical; submentum coarsely punctate. *Prothorax.* Pronotum nearly semicircular, perceptibly angulate at anterolateral corners, basal lobe shallow, disk convex, somewhat depressed along base, surface finely foveolate, foveolae more dense on each lateral 0.33 of disk, intervals minutely punctate; lateral margin carinate and arcuate; hypopleuron concave; cervical sulcus extending from near anterior end of lateral carina to a point behind upper margin of eye; cervical boss bisetose; prosternum Y-shaped, with shallow sulcus before procoxae, intercoxal process flat, margins slightly constricted, apex bluntly attenuate. *Mesothorax and Metathorax.* Scutellum $2 \times$ as long as wide, constricted at middle, tridentate apically. Elytra $1.5 \times$ as long as wide, depressed around scutellum, striae regular in course except base of fourth closer to third than to fifth, sixth and seventh usually conjoined apically; striae moderately deep, regularly punctate, interstices nearly flat. Mesosternum nearly vertical, apex abruptly bent caudad and channeled to receive apex of prosternum; postmesocoxal sulci joined at midline and extending laterad to pleurosternal suture; metepisternal parasutural sulcus extending to metacoxal cavity, abruptly bent at anterior end and ending at elytral margin, metepisternal disk with arcuate stridulatory file extending anteriorly from coxal cavity $0.75 \times$ length of sclerite (Fig. 10). Metacoxal face sparsely, evenly punctate in middle 0.33, and with dense cluster of punctures near trochanteral fossa. Front and middle legs not modified; metafemur with angulate tooth on ventromesal margin (Fig. 11), mesal face of tooth finely striate;



Figures 10–11. *Amblycerus stridulator*. Figure 10. SEM of metepisternum showing “file.” Figure 11. SEM of ventromesal margin of hind leg showing “scraper” or tooth with many fine striations on ventral margin.

lateral metatibial spur 2× as long as mesal spur. *Abdomen*. Sternum 5 nearly as long as remaining 4 together; sternum 5 broadly emarginate apically; pygidium nearly semicircular, disk densely, irregularly microfoveolate. *Genitalia* (Figs. 12, 13, 14). Median lobe more than 3× as long as wide; ventral valve subtriangular, lateral margins concave; dorsal valve subelliptical, extending beyond apex of ventral valve; internal sac armed with 3 types of paired sclerites: a pair of flat blades with serrate lateral margins, a pair of large, falcate, thorn-like sclerites with swollen bases, and a pair of irregularly twisted,



Figures 12–14. *Amblycerus stridulator*. Male genitalia: Figure 12. Median lobe, ventral view. Figure 13. Sclerite of internal sac. Figure 14. Lateral lobes, ventral view.

densely spiny lobes; apex of sac membranous and plicate. Lateral lobes cleft to 0.26 their length, Y-shaped, truncate and setose apically, median strap with minute, cylindrical sensillae (Fig. 14).

Female.—Similar to male except fifth sternum evenly rounded.

Diagnosis.—*Amblycerus stridulator* can be separated from *A. pollens* and *A. eustrophoides* by its file, which is transverse to the metepisternal sulcus (see discussion).

Host Plants.—*Caesalpinia sclerocarpa* Standley.

Distribution.—Mexico.

Etymology.—The name *stridulator* is a noun in apposition to *Amblycerus*. It refers to the apparent stridulatory structures of this species.

DISCUSSION

Systematics.—In addition to *A. stridulator*, *A. eustrophoides* and *A. pollens* have a fusiform node with transverse striations (Figs. 1, 5) on the metepisternum and an apical tooth on the metafemur (Figs. 2, 6). The species differ, however, in the sclerites in the internal sac (Figs. 3, 7), patterns of pubescence, and the position of the fusiform node on the metepisternum. *Amblycerus stridulator* is distinct from *A. pollens* and *A. eustrophoides* as the latter two species are more similar to

one another in external morphology (revisionary studies currently under way indicate, however, that the three species are in different species groups). *Amblycerus pollens* and *A. eustrophoides* have files that apparently are a modification of the longitudinal axis of the metepisternal sulcus, and the tooth (scraper) on the hind femur is not striate. The sclerites in the internal sac of both species are similar in shape and number, especially the spiny subelliptic plates and the blade-shaped, serrate sclerite. Also, the lateral lobes (Figs. 4, 9) do not have pads between their apices.

The file of *A. stridulator* is transverse to the metepisternal sulcus (Fig. 10), apparently originating as a modification of the metepisternum. The tooth on the hind femur has fine striations over its entire surface (Fig. 11). The internal sac of the male genitalia has only the blade-shaped serrate sclerites (Fig. 12) that are similar to those in *A. pollens* and *A. eustrophoides*. The lateral lobes have a pair of pubescent pads between them (Fig. 14). Unfortunately the host plants of *A. pollens* are unknown. That *A. stridulator* feeds on *Caesalpinia sclerocarpa* (Fabaceae) and *A. eustrophoides* in *Drypetes laterifolia* (Swartz) (Euphorbiaceae) is of significant value. Because *A. pollens* is more similar to *A. eustrophoides* increases the possibility that *A. pollens* may feed in a Euphorbiaceae. This suggests that two lines of development have occurred, with *A. stridulator* more distant from the other two species in both morphology and host plant preferences.

Stridulation.—Because we have no evidence that these three species actually produce sounds, we can do no more than hypothesize here. The “files” in our scanning electron micrographs (Figs. 1, 10) are remarkably similar to those in six species of criocerine Chrysomelidae studied by Schmitt & Traue (1990). Bruchids are very closely related to chrysomelids. Unlike the three bruchids, the sounds produced by the chrysomelids were discovered long before the mechanism for producing them. Schmitt and Traue hypothesized that the sounds produced by the chrysomelids were similar to “disturbance sounds” of other insects because they could not detect species-specific differences in sounds nor sexual dimorphism of the stridulatory organs. They used oscillograms, frequency spectra and sonagrams for their analyses. The files of the chrysomelids were located on “the last perceptible abdominal tergite, the so-called pygidium, and adjoined the rostral margin of the pygidium.” The plectra (scrapers) “were situated on the underside of the elytra in the hind sutural angles.” Sounds were produced during contraction of the abdomen.

Kingsolver (1970) observed that *A. eustrophoides* has a unique structure for bruchids: a fusiform node with transverse striations on the metepisternum. He hypothesized that this structure on *A. eustrophoides* “was apparently a stridulatory mechanism” when rubbed against a spine on the ventral margin of the metafemur. Thus, the structure on the metepisternum may be a file and the spine on the metafemur a scraper (plectrum). Because three species of bruchids are now known to possess what appear to be files and scrapers, we will begin a study shortly on *A. stridulator*, the species whose hosts, and thus living specimens, are most accessible.

ACKNOWLEDGMENT

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